WHITE PAPER

USDA Forest Service | Pacific Northwest Region | Umatilla National Forest

**WHITE PAPER F14-SO-WP-SILV-22**

# Range of Variation Recommendations for Insect and Disease Susceptibility[1]


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## INTRODUCTION AND ASSUMPTIONS

This white paper provides susceptibility percentages, expressed as ranges, for nine insects or diseases of Blue Mountain forests. Forest insects and diseases occupy forest vegetation as their habitat, so each set of susceptibility ratings is associated with a corresponding set of reference vegetation conditions. Reference conditions are expressed as percentage ranges for each of four vegetation attributes: species composition, forest structural stage, forest canopy layering, and tree (stand) density.

Reference vegetation conditions were selected to be compatible with rating factors used in this document: *Rating forest stands for insect and disease susceptibility: a simplified approach* (Schmitt and Powell 2005). The rating factors are compatible with the Umatilla National Forest's composite vegetation database (Powell 2004), and with more recent databases developed by using Most Similar Neighbor or Nearest Neighbor imputation procedures (Crookston et al. 2002, Moeur and Stage 1995). Rating factors pertain to nine individual or grouped insect and disease agents (not all factors are used with every agent).

Estimated historical vegetation conditions were categorized for each of three upland-forest potential vegetation groups (PVG): dry, moist, and cold. PVGs function

[1] White papers are internal reports and receive only limited review. Viewpoints expressed here are those of the authors – they may not represent positions of the USDA Forest Service.

as an effective ecological stratification unit because they reflect differences in inherent site potential and disturbance regimes. Information by PVG is provided as separate sections in this document.

The PVG stratification is based on information contained in this report: *Potential vegetation hierarchy for the Blue Mountains section of northeastern Oregon, southeastern Washington, and west-central Idaho* (Powell et al. 2007).

Estimated reference vegetation conditions were compiled by David C. Powell from a variety of published and unpublished sources (Powell 2012). When combining the subcategory values for a particular attribute, vegetation ranges will sum to 60-130% (four attributes are used to characterize reference conditions: species composition, forest structural stage, forest canopy layering, and stand density).

For each PVG, a set of initial conditions are provided for one scenario: low departure from reference conditions. Conditions associated with this low departure scenario are assumed to most closely approximate the historical range of variability for forest ecosystems, which is defined as presettlement conditions for a time period of approximately 1800-1850.

Susceptibility is defined as the relative probability (low, moderate, high) of insect or disease agents being present and causing disturbance. Percentage ranges for insect and disease susceptibility were developed by Craig L. Schmitt, and they reflect professional judgment about the relative amounts of insect or disease susceptibility associated with the reference vegetation conditions, along with information from published reports characterizing the susceptibility associated with early forest conditions (Hessburg et al. 1994, Swetnam et al. 1995, Keen and Miller 1960).

Susceptibility ranges reflect combinations of species composition, forest structural stage, forest canopy layering, and stand density as components of insect or disease habitat; ranges are assumed to represent the insect or disease susceptibility associated with forest vegetation having little or no departure from reference conditions. When combining the subcategory values for a particular insect or disease agent, susceptibility ranges will sum to 60-130%. Nine insect or disease agents are included in this white paper: defoliators, Douglas-fir beetle, fir engraver, spruce beetle, bark beetles in ponderosa pine, mountain pine beetle in lodgepole pine, Douglas-fir dwarf mistletoe, western larch dwarf mistletoe, and root diseases.

An important use of the susceptibility ranges is for forest vegetation project planning, a process involving an analysis of existing and desired conditions. Desired conditions are derived from several sources, including the Land and Resource Management Plan for a national forest. When existing conditions deviate significantly from desired conditions, the purpose and need for a project is to modify existing conditions to be closer to desired conditions. The proposed action, and alternatives to it, examine various scenarios for how these modifications could occur. Silvicultural practices, such as thinning or prescribed fire, are often proposed as actions for modifying vegetation conditions. And a characterization of insect or disease susceptibility is frequently used as a desired condition during the project planning process.

## DRY UPLAND FOREST POTENTIAL VEGETATION GROUP

Powell and others (2007) describe the potential vegetation composition, by plant association, of the Dry Upland Forest potential vegetation group (PVG) (see table 2 on page 20 of that source).

Dry upland forests tend to occur at low to moderate elevations of the montane vegetation zone. Late-seral stands are dominated by ponderosa pine, grand fir, or Douglas-fir as the climax tree species, while ponderosa pine or Douglas-fir function as early- or mid-seral species depending on plant association. Western juniper is expanding rapidly into this PVG as a result of fire exclusion and climate change, moving upward from a foothills woodland zone located below the montane zone. Dry forests are adjoined by moist upland forests at their upper edge, and by the woodlands and shrublands of the foothills vegetation zone at their lower edge.

For the Blue Mountains, the Dry Upland Forest PVG consists of three plant association groups (PAG) – one from the warm temperature regime (Warm Dry PAG), and two from the hot temperature regime (Hot Moist and Hot Dry PAGs). Of the three PAGs, Warm Dry is by far and away the most common member of the Dry Upland Forest PVG.

Warm, dry forests tend to be the most common forest zone in the Blue Mountains, and because they occur at the lowest forested elevations, they have a long history of human use – both for commodity purposes (such as domestic livestock grazing and timber production), and as an area where effective fire exclusion occurred early on and eventually led to notable changes in species composition, forest structure, and stand density. Dry-forest sites were historically dominated by ponderosa pine because it is well adapted to survive in a fire regime featuring low-severity fires occurring every 5 to 20 years.

Common dry-forest undergrowth species feature graminoids and mid-height shrubs. Elk sedge and pinegrass are ubiquitous graminoids, while birchleaf spiraea, snowberry, ninebark, and bitterbrush are common shrubs. On the very driest sites, the Dry Upland Forest PVG has mountain-mahogany, big sagebrush, bluebunch wheatgrass, and western juniper (Hot Dry PAG).

Insect and disease agents of notable importance for dry-forest sites include defoliating insects (western spruce budworm and Douglas-fir tussock moth), Douglas-fir dwarf mistletoe, and bark beetles in ponderosa pine. Recent high levels of defoliator activity on dry-forest sites reflect a significant tree species shift during the past 75 years – Douglas-fir and grand fir (two host species) were able to invade sites historically dominated by non-host ponderosa pine because human activity suppressed the native disturbance regime – surface fire occurring on a frequency of 5-20 years.

*Example of a dry upland forest site, showing a moderate canopy cover of ponderosa pine and an undergrowth dominated by graminoids (primarily elk sedge and pinegrass). Note that this stand is beginning to transition toward a multi-layered condition, and away from the single-layer structure produced by the historical fire regime.*

## Historical Vegetation Conditions For Dry Upland Forests

Estimates of the historical species composition, forest structural stage, forest canopy layering, and tree (stand) density conditions for Dry UF landscapes with **little or no departure from reference conditions are:**

a. Species composition

| | |
|---|---|
| ponderosa pine: | **50-90%** |
| Douglas-fir: | **5-20%** |
| grand fir: | **5-10%** |
| lodgepole pine: | **0-5%** |
| western larch: | **0-5%** |

b. Forest structural stage

| | |
|---|---|
| stand initiation (tree diameter <5"): | **5-15%** |
| stem exclusion (tree diameter 5-20"): | **10-25%** |
| understory reinitiation (tree diameter 5-20"): | **10-25%** |
| old forest (tree diameter ≥21"): | **35-65%** |

c. Forest canopy layering

| | |
|---|---|
| single layer: | **45-85%** |
| multiple layers (>1): | **15-45%** |

d. Stand density (mixed species at a quadratic mean diameter of 10 inches)

| | |
|---|---|
| low (<40% canopy cover; <45 $ft^2$/ac basal area; <81 sdi[2] or tpa): | **40-85%** |
| moderate (40-50% cover; 45-70 $ft^2$/ac basal area; 81-121 sdi or tpa): | **15-30%** |
| high (>50% canopy cover; >70 $ft^2$/ac basal area; >121 sdi or tpa): | **5-15%** |

[2] The tpa and sdi values are identical because stand density index is referenced to a 10" quadratic mean diameter, so sdi and tpa values are the same when QMD is 10" (but they would not be the same for any QMD other than 10").

## Insect And Disease Susceptibility For Dry Upland Forests

Estimates of insect or disease susceptibility associated with the historical vegetation conditions described above for Dry Upland Forests are:

1. Susceptibility to defoliators for historical Dry UF vegetation conditions
   low (percentage as a range): **40-85%**
   moderate (percentage as a range): **15-30%**
   high (percentage as a range): **5-15%**
2. Susceptibility to Douglas-fir beetle for historical Dry UF vegetation conditions
   low (percentage as a range): **35-75%**
   moderate (percentage as a range): **15-30%**
   high (percentage as a range): **10-25%**
3. Susceptibility to fir engraver for historical Dry UF vegetation conditions
   low (percentage as a range): **45-95%**
   moderate (percentage as a range): **10-25%**
   high (percentage as a range): **5-10%**
4. Susceptibility to spruce beetle for historical Dry UF vegetation conditions
   low (percentage as a range): **N/A**
   moderate (percentage as a range): **N/A**
   high (percentage as a range): **N/A**
5. Susceptibility to bark beetles in ponderosa pine for historical Dry UF vegetation conditions
   low (percentage as a range): **35-75%**
   moderate (percentage as a range): **15-35%**
   high (percentage as a range): **10-20%**
6. Susceptibility to mountain pine beetle in lodgepole pine for historical Dry UF vegetation conditions
   low (percentage as a range): **55-90%**
   moderate (percentage as a range): **5-35%**
   high (percentage as a range): **0-5%**
7. Susceptibility to Douglas-fir dwarf mistletoe for historical Dry UF vegetation conditions
   low (percentage as a range): **30-60%**
   moderate (percentage as a range): **10-35%**
   high (percentage as a range): **20-35%**
8. Susceptibility to western larch dwarf mistletoe for historical Dry UF vegetation conditions
   low (percentage as a range): **55-95%**
   moderate (percentage as a range): **5-30%**
   high (percentage as a range): **0-5%**
9. Susceptibility to root diseases for historical Dry UF vegetation conditions
   low (percentage as a range): **35-75%**
   moderate (percentage as a range): **20-35%**
   high (percentage as a range): **5-20%**

## MOIST UPLAND FOREST POTENTIAL VEGETATION GROUP

Powell and others (2007) describe the potential vegetation composition, by plant association, of the Moist Upland Forest potential vegetation group (PVG) (see table 2, pages 19-20, of that source).

Moist upland forests tend to occur at moderate elevations in the montane vegetation zone, or at low elevations of the subalpine zone. Late-seral stands are dominated by subalpine fir, grand fir, or Douglas-fir as the climax tree dominants, while lodgepole pine or western larch often occur as early-seral species in this PVG. Douglas-fir and western white pine function as mid-seral species (except on sites where Douglas-fir is climax). Moist forests are adjoined by cold upland forests at their upper edge, and by dry upland forests at their lower edge.

For the Blue Mountains, the Moist Upland Forest PVG consists of five plant association groups (PAG) – three in the cool temperature regime (Cool Wet, Cool Very Moist, and Cool Moist PAGs), and two in the warm temperature regime (Warm Very Moist and Warm Moist PAGs). The Cool Moist PAG is by far and away the most common member of the Moist Upland Forest PVG.

Cool, moist forests tend to occupy the most productive forested environments of the Blue Mountains because moisture is usually not limiting – the temperate nature of this PAG is reflected in high species diversity and a closed forest structure. The high species diversity pertains to both the overstory (forest) composition and to the undergrowth plant union.

Moist-forest undergrowths are dominated by forbs, some mid-height shrubs, and a few tall shrubs on warmer environments. Moist-site plants such as queencup beadlily, twinflower, false bugbane, swordfern, and ginger occur in this zone, but the most common mesic environments within the Moist Upland Forest PVG have big huckleberry as the undergrowth dominant. Moist forests at the warm end of the temperature spectrum feature mid or tall shrubs such as Rocky Mountain maple, ninebark, and oceanspray – these occur in the Warm Very Moist and Warm Moist plant association groups.

Insect and disease agents of notable importance for moist-forest sites include defoliating insects such as western spruce budworm and Douglas-fir tussock moth, Douglas-fir beetle, fir engraver, spruce beetle, mountain pine beetle in lodgepole pine, Douglas-fir dwarf mistletoe, western larch dwarf mistletoe, and several different root diseases (particularly Armillaria and annosus root diseases, along with localized occurrences of laminated root rot).

*Example of a moist upland forest site, showing a relatively dense overstory canopy of grand fir and an undergrowth dominated by low forbs (primarily ginger, twinflower, and darkwoods violet on this site). Note the dense sward of bracken immediately behind the large trees, and Sitka alder in a small opening behind the bracken fern.*

## Historical Vegetation Conditions For Moist Upland Forests

Estimates of the historical species composition, forest structural stage, forest canopy layering, and tree (stand) density conditions for Moist UF landscapes with **little or no departure from reference conditions are:**

a. Species composition

| | |
|---|---|
| ponderosa pine: | **5-15%** |
| Douglas-fir: | **15-25%** |
| western larch: | **15-25%** |
| lodgepole pine: | **10-25%** |
| grand fir: | **15-30%** |
| Engelmann spruce-subalpine fir: | **0-10%** |

b. Forest structural stage

| | |
|---|---|
| stand initiation (tree diameter <5"): | **5-15%** |
| stem exclusion (tree diameter 5-20"): | **5-30%** |
| understory reinitiation (tree diameter 5-20"): | **30-45%** |
| old forest (tree diameter ≥21"): | **20-40%** |

c. Forest canopy layering

| | |
|---|---|
| single layer: | **10-45%** |
| multiple layers (>1): | **50-85%** |

d. Stand density (mixed species at a quadratic mean diameter of 10 inches)

| | |
|---|---|
| low (<75% canopy cover; <90 $ft^2$/ac basal area; <163 sdi[3] or tpa): | **20-40%** |
| moderate (75-85% cover; 90-135 $ft^2$/ac basal area; 163-244 sdi or tpa): | **25-60%** |
| high (>85% canopy cover; >135 $ft^2$/ac basal area; >244 sdi or tpa): | **15-30%** |

[3] See footnote 2.

## Insect And Disease Susceptibility For Moist Upland Forests

Estimates of insect or disease susceptibility associated with the historical vegetation conditions described above for Moist Upland Forests are:

1. Susceptibility to defoliators for historical Moist UF vegetation conditions
   low (percentage as a range): **5-20%**
   moderate (percentage as a range): **20-30%**
   high (percentage as a range): **35-80%**
2. Susceptibility to Douglas-fir beetle for historical Moist UF veg. conditions
   low (percentage as a range): **30-60%**
   moderate (percentage as a range): **20-40%**
   high (percentage as a range): **10-30%**
3. Susceptibility to fir engraver for historical Moist UF vegetation conditions
   low (percentage as a range): **30-70%**
   moderate (percentage as a range): **10-20%**
   high (percentage as a range): **20-40%**
4. Susceptibility to spruce beetle for historical Moist UF vegetation conditions
   low (percentage as a range): **50-95%**
   moderate (percentage as a range): **10-25%**
   high (percentage as a range): **0-10%**
5. Susceptibility to bark beetles in ponderosa pine for historical Moist UF vegetation conditions
   low (percentage as a range): **30-65%**
   moderate (percentage as a range): **15-30%**
   high (percentage as a range): **15-35%**
6. Susceptibility to mountain pine beetle in lodgepole pine for historical Moist UF vegetation conditions
   low (percentage as a range): **30-60%**
   moderate (percentage as a range): **25-40%**
   high (percentage as a range): **5-30%**
7. Susceptibility to Douglas-fir dwarf mistletoe for historical Moist UF vegetation conditions
   low (percentage as a range): **30-65%**
   moderate (percentage as a range): **20-45%**
   high (percentage as a range): **10-20%**
8. Susceptibility to western larch dwarf mistletoe for historical Moist UF vegetation conditions
   low (percentage as a range): **5-20%**
   moderate (percentage as a range): **15-40%**
   high (percentage as a range): **40-70%**
9. Susceptibility to root diseases for historical Moist UF vegetation conditions
   low (percentage as a range): **5-25%**
   moderate (percentage as a range): **20-40%**
   high (percentage as a range): **35-65%**

## COLD UPLAND FOREST POTENTIAL VEGETATION GROUP

Powell and others (2007) describe the potential vegetation composition, by plant association, for the Cold Upland Forest potential vegetation group (PVG) (see table 2 on pages 18-19 of that source).

Cold upland forests tend to occur at moderate or high elevations in the subalpine zone. Late-seral stands are dominated by subalpine fir or Engelmann spruce as climax tree dominants, while lodgepole pine or whitebark pine often function as persistent, early-seral species. Cold forests are adjoined by a treeless alpine zone at their upper edge (sometimes separated by a narrow zone of dwarf or krummholz trees at upper treeline), and by moist upland forests at their lower edge.

For the Blue Mountains, the Cold Upland Forest PVG consists of three plant association groups (PAG) – two in the cold temperature regime (Cold Moist and Cold Dry PAGs), and one in the cool temperature regime (Cool Dry PAG). The Cold Dry PAG is by far and away the most common member of the Cold Upland Forest PVG.

Cold, dry subalpine forests (Cold Dry PAG) tend to be the most xeric of upper-elevation forested communities, often occurring on west- to south-facing slopes with moderate or high impact from wind scour. Due to wind effects, shallow soils, and other abiotic factors, many of the cold dry forests have an open canopy structure. These sites are generally above the cold tolerance limits of Douglas-fir, but this species is sometimes found as a mid-seral species on sheltered landform positions.

Common cold-forest undergrowth species are dominated by herbs and dwarf shrubs. Areas with physiographic and soil characteristics suitable for supporting forests with at least moderate canopy cover frequently have one or more of the ericaceous *Vaccinium* species as undergrowth dominants (generally *Vaccinium scoparium*, but sometimes *V. cespitosum* or *V. myrtillus*). Areas with steeper slopes or shallower soils support open-canopy stands and an herb-dominated undergrowth (often featuring elk sedge, Ross' sedge, needlegrass, green fescue, etc.).

Cold upland forests at the highest elevations tend to feature a persistent component of whitebark pine, and these communities often have an undergrowth reminiscent of the alpine flora found above the forest zone (including species such as sandwort, mountainheath, fleeceflower, etc.).

Insect and disease agents of notable importance for cold forests include spruce beetle, mountain pine beetle in lodgepole pine, and western larch dwarf mistletoe.

*Example of a cold upland forest site, showing a relatively open overstory canopy of Engelmann spruce and subalpine fir, and an undergrowth dominated by low ericaceous shrubs (primarily* Vaccinium scoparium *and* V. myrtillus *on this site).*

## Historical Vegetation Conditions For Cold Upland Forests

Estimates of the historical species composition, forest structural stage, forest canopy layering, and tree (stand) density conditions for Cold UF landscapes with **little or no departure from reference conditions are:**

a. Species composition

| | |
|---|---|
| ponderosa pine: | **0-5%** |
| Douglas-fir: | **5-15%** |
| western larch: | **5-15%** |
| lodgepole pine: | **25-45%** |
| grand fir: | **5-15%** |
| Engelmann spruce-subalpine fir: | **20-35%** |

b. Forest structural stage

| | |
|---|---|
| stand initiation (tree diameter <5"): | **10-30%** |
| stem exclusion (tree diameter 5-20"): | **15-35%** |
| understory reinitiation (tree diameter 5-20"): | **5-20%** |
| old forest (tree diameter ≥21"): | **30-45%** |

c. Forest canopy layering

| | |
|---|---|
| single layer: | **25-65%** |
| multiple layers (>1): | **35-65%** |

d. Stand density (mixed species at a quadratic mean diameter of 10 inches)

| | |
|---|---|
| low (<60% canopy cover; <70 ft²/ac basal area; <132 sdi[4] or tpa): | **15-30%** |
| moderate (60-70% cover; 70-110 ft²/ac basal area; 132-197 sdi or tpa): | **20-40%** |
| high (>70% canopy cover; >110 ft²/ac basal area; >197 sdi or tpa): | **25-60%** |

[4] See footnote 2.

## Insect And Disease Susceptibility For Cold Upland Forests

Estimates of insect or disease susceptibility associated with the historical vegetation conditions described above for Cold Upland Forests are:

1. Susceptibility to defoliators for historical Cold UF vegetation conditions
   low (percentage as a range): **40-95%**
   moderate (percentage as a range): **15-25%**
   high (percentage as a range): **5-10%**
2. Susceptibility to Douglas-fir beetle for historical Cold UF veg. conditions
   low (percentage as a range): **45-95%**
   moderate (percentage as a range): **10-25%**
   high (percentage as a range): **5-10%**
3. Susceptibility to fir engraver for historical Cold UF vegetation conditions
   low (percentage as a range): **35-75%**
   moderate (percentage as a range): **20-45%**
   high (percentage as a range): **5-10%**
4. Susceptibility to spruce beetle for historical Cold UF vegetation conditions
   low (percentage as a range): **10-30%**
   moderate (percentage as a range): **30-50%**
   high (percentage as a range): **20-50%**
5. Susceptibility to bark beetles in ponderosa pine for historical Cold UF vegetation conditions
   low (percentage as a range): **55-95%**
   moderate (percentage as a range): **5-30%**
   high (percentage as a range): **0-5%**
6. Susceptibility to mountain pine beetle in lodgepole pine for historical Cold UF vegetation conditions
   low (percentage as a range): **30-50%**
   moderate (percentage as a range): **15-40%**
   high (percentage as a range): **15-40%**
7. Susceptibility to Douglas-fir dwarf mistletoe for historical Cold UF conditions
   low (percentage as a range): **40-90%**
   moderate (percentage as a range): **20-30%**
   high (percentage as a range): **0-10%**
8. Susceptibility to western larch dwarf mistletoe for historical Cold UF vegetation conditions
   low (percentage as a range): **10-20%**
   moderate (percentage as a range): **20-50%**
   high (percentage as a range): **30-60%**
9. Susceptibility to root diseases for historical Cold UF vegetation conditions
   low (percentage as a range): **30-65%**
   moderate (percentage as a range): **20-45%**
   high (percentage as a range): **10-20%**

## REFERENCES


**Crookston, N.L.; Moeur, M.; Renner, D. 2002.** Users guide to the most similar neighbor imputation program, version 2. Gen. Tech. Rep. RMRS-GTR-96. Fort Collins, CO: USDA Forest Service, Rocky Mountain Research Station. 35 p. http://www.treesearch.fs.fed.us/pubs/4813

**Hessburg, P.F.; Mitchell, R.G.; Filip, G.M. 1994.** Historical and current roles of insects and pathogens in eastern Oregon and Washington forested landscapes. Gen. Tech. Rep. PNW-GTR-327. Portland, OR: USDA Forest Service, Pacific Northwest Research Station. 72 p. http://www.treesearch.fs.fed.us/pubs/6390

**Miller, J.M.; Keen, F.P. 1960.** Biology and control of the western pine beetle. Misc. Pub. 800. Washington, DC: USDA Forest Service. 381 p.

**Moeur, M.; Stage, A.R. 1995.** Most similar neighbor: an improved sampling inference procedure for natural resource planning. Forest Science. 41(2): 337-359.

**Munger, T.T. 1917.** Western yellow pine in Oregon. Bull. No. 418. Washington, DC: U.S. Department of Agriculture. 48 p. Western Yellow Pine

**Powell, D.C. 2004.** Description of composite vegetation database. White Paper F14-SO-WP-Silv-2. Pendleton, OR: USDA Forest Service, Pacific Northwest Region, Umatilla National Forest. 34 p. Composite WP

**Powell, D.C. 2012.** Range of variation recommendations for dry, moist, and cold forests. White Paper F14-SO-WP-Silv-3. Pendleton, OR: USDA Forest Service, Pacific Northwest Region, Umatilla National Forest. 55 p. RV White Paper

**Powell, D.C.; Johnson, C.G., Jr.; Crowe, E.A.; Wells, A.; Swanson, D.K. 2007.** Potential vegetation hierarchy for the Blue Mountains section of northeastern Oregon, southeastern Washington, and west-central Idaho. Gen. Tech. Rep. PNW-GTR-709. Portland, OR: USDA Forest Service, Pacific Northwest Research Station. 87 p. http://www.treesearch.fs.fed.us/pubs/27598

**Schmitt, Craig L.; Powell, David C. 2005.** Rating forest stands for insect and disease susceptibility: a simplified approach; version 2.0. Pub. BMPMSC-05-01. La Grande, OR: USDA Forest Service, Pacific Northwest Region, Wallowa-Whitman National Forest, Blue Mountains Pest Management Service Center. 20 p. Susceptibility Rating

**Swetnam, T.W.; Wickman, B.E.; Paul, H.G.; Baisan, C.H. 1995.** Historical patterns of western spruce budworm and Douglas-fir tussock moth outbreaks in the northern Blue Mountains, Oregon since A.D. 1700. Res. Pap. PNW-RP-484. Portland, OR: USDA Forest Service, Pacific Northwest Research Station. 27 p. http://www.treesearch.fs.fed.us/pubs/20594

## APPENDIX: SILVICULTURE WHITE PAPERS

White papers are internal reports, and they are produced with a consistent formatting and numbering scheme – all papers dealing with Silviculture, for example, are placed in a silviculture series (Silv) and numbered sequentially. Generally, white papers receive only limited review and, in some instances pertaining to highly technical or narrowly focused topics, the papers may receive no technical peer review at all. For papers that receive no review, the viewpoints and perspectives expressed in the paper are those of the author only, and do not necessarily represent agency positions of the Umatilla National Forest or the USDA Forest Service.

Large or important papers, such as two papers discussing active management considerations for dry and moist forests (white papers Silv-4 and Silv-7, respectively), receive extensive review comparable to what would occur for a research station general technical report (but they don't receive blind peer review, a process often used for journal articles).

White papers are designed to address a variety of objectives:

(1) They guide how a methodology, model, or procedure is used by practitioners on the Umatilla National Forest (to ensure consistency from one unit, or project, to another).

(2) Papers are often prepared to address ongoing and recurring needs; some papers have existed for more than 20 years and still receive high use, indicating that the need (or issue) has long standing – an example is white paper #1 describing the Forest's big-tree program, which has operated continuously for 25 years.

(3) Papers are sometimes prepared to address emerging or controversial issues, such as management of moist forests, elk thermal cover, or aspen forest in the Blue Mountains. These papers help establish a foundation of relevant literature, concepts, and principles that continuously evolve as an issue matures, and hence they may experience many iterations through time. [But also note that some papers have not changed since their initial development, in which case they reflect historical concepts or procedures.]

(4) Papers synthesize science viewed as particularly relevant to geographical and management contexts for the Umatilla National Forest. This is considered to be the Forest's self-selected 'best available science' (BAS), realizing that non-agency commenters would generally have a different conception of what constitutes BAS – like beauty, BAS is in the eye of the beholder.

(5) The objective of some papers is to locate and summarize the science germane to a particular topic or issue, including obscure sources such as master's theses or Ph.D. dissertations. In other instances, a paper may be designed to wade through an overwhelming amount of published science (dry-forest management), and then synthesize sources viewed as being most relevant to a local context.

(6) White papers function as a citable literature source for methodologies, models, and procedures used during environmental analysis – by citing a white paper,

specialist reports can include less verbiage describing analytical databases, techniques, and so forth, some of which change little (if at all) from one planning effort to another.

(7) White papers are often used to describe how a map, database, or other product was developed. In this situation, the white paper functions as a 'user's guide' for the new product. Examples include papers dealing with historical products: (a) historical fire extents for the Tucannon watershed (WP Silv-21); (b) an 1880s map developed from General Land Office survey notes (WP Silv-41); and (c) a description of historical mapping sources (24 separate items) available from the Forest's history website (WP Silv-23).

These papers are available from the Forest's website: Silviculture White Papers

| Paper # | Title |
|---|---|
| 1 | Big tree program |
| 2 | Description of composite vegetation database |
| 3 | Range of variation recommendations for dry, moist, and cold forests |
| 4 | Active management of dry forests in the Blue Mountains: silvicultural considerations |
| 5 | Site productivity estimates for upland forest plant associations of the Blue and Ochoco Mountains |
| 6 | Fire regimes of the Blue Mountains |
| 7 | Active management of moist forests in the Blue Mountains: silvicultural considerations |
| 8 | Keys for identifying forest series and plant associations of the Blue and Ochoco Mountains |
| 9 | Is elk thermal cover ecologically sustainable? |
| 10 | A stage is a stage is a stage…or is it? Successional stages, structural stages, seral stages |
| 11 | Blue Mountains vegetation chronology |
| 12 | Calculated values of basal area and board-foot timber volume for existing (known) values of canopy cover |
| 13 | Created openings: direction from the Umatilla National Forest land and resource management plan |
| 14 | Description of EVG-PI database |
| 15 | Determining green-tree replacements for snags: a process paper |
| 16 | Douglas-fir tussock moth: a briefing paper |
| 17 | Fact sheet: Forest Service trust funds |
| 18 | Fire regime condition class queries |
| 19 | Forest health notes for an Interior Columbia Basin Ecosystem Management Project field trip on July 30, 1998 (handout) |
| 20 | Height-diameter equations for tree species of the Blue and Wallowa Mountains |

| Paper # | Title |
|---|---|
| 21 | Historical fires in the headwaters portion of the Tucannon River watershed |
| 22 | Range of variation recommendations for insect and disease susceptibility |
| 23 | Historical vegetation mapping |
| 24 | How to measure a big tree |
| 25 | Important insects and diseases of the Blue Mountains |
| 26 | Is this stand overstocked? An environmental education activity |
| 27 | Mechanized timber harvest: some ecosystem management considerations |
| 28 | Common plants of the south-central Blue Mountains (Malheur National Forest) |
| 29 | Potential natural vegetation of the Umatilla National Forest |
| 30 | Potential vegetation mapping chronology |
| 31 | Probability of tree mortality as related to fire-caused crown scorch |
| 32 | Review of the "Integrated scientific assessment for ecosystem management in the interior Columbia basin, and portions of the Klamath and Great basins" – forest vegetation |
| 33 | Silviculture facts |
| 34 | Silvicultural activities: description and terminology |
| 35 | Site potential tree height estimates for the Pomeroy and Walla Walla ranger districts |
| 36 | Tree density protocol for mid-scale assessments |
| 37 | Tree density thresholds as related to crown-fire susceptibility |
| 38 | Umatilla National Forest Land and Resource Management Plan: forestry direction |
| 39 | Updates of maximum stand density index and site index for the Blue Mountains variant of the Forest Vegetation Simulator |
| 40 | Competing vegetation analysis for the southern portion of the Tower Fire area |
| 41 | Using General Land Office survey notes to characterize historical vegetation conditions for the Umatilla National Forest |
| 42 | Life history traits for common conifer trees of the Blue Mountains |
| 43 | Timber volume reductions associated with green-tree snag replacements |
| 44 | Density management field exercise |
| 45 | Climate change and carbon sequestration: vegetation management considerations |
| 46 | The Knutson-Vandenberg (K-V) program |
| 47 | Active management of quaking aspen plant communities in the northern Blue Mountains: regeneration ecology and silvicultural considerations |
| 48 | The Tower Fire…then and now. Using camera points to monitor postfire recovery |
| 49 | How to prepare a silvicultural prescription for uneven-aged management |

| Paper # | Title |
|---|---|
| 50 | Stand density conditions for the Umatilla National Forest: a range of variation analysis |
| 51 | Restoration opportunities for upland forest environments of the Umatilla National Forest |
| 52 | New perspectives in riparian management: Why might we want to consider active management for certain portions of riparian habitat conservation areas? |
| 53 | Eastside Screens chronology |
| 54 | Using mathematics in forestry: an environmental education activity |
| 55 | Silviculture certification: tips, tools, and trip-ups |
| 56 | Vegetation polygon mapping and classification standards: Malheur, Umatilla, and Wallowa-Whitman national forests |
| 57 | The state of vegetation databases on the Malheur, Umatilla, and Wallowa-Whitman national forests |

## REVISION HISTORY

**February 2012**: formatting and editing changes were made; susceptibility ranges were adjusted for all three of the potential vegetation groups; appendix 2 was added describing the white paper system, including a list of available white papers.